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FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

5729

January 8, 1993

Ms. Donna R. Searcy  
Secretary  
Federal Communications Commission  
Room 222  
1919 M Street, N.W.  
Washington, D.C. 20554

Re: General Docket No. / 90-314  
ET Docket 92-100

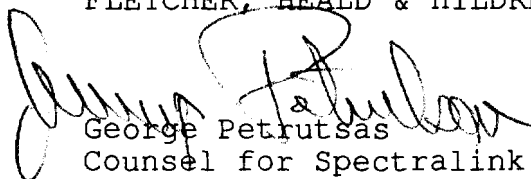
Dear Ms. Searcy:

On behalf of Spectralink Corporation, we are filing an original and five (5) copies of its Reply Comments in the above-referenced consolidated proceeding.

Please communicate with the undersigned if additional information is needed.

Respectfully submitted,

FLETCHER, HEALD & HILDRETH

  
George Petrutsas  
Counsel for Spectralink Corporation

GP:cej  
Enclosures

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FEDERAL COMMUNICATIONS COMMISSION  
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In the Matter of	)	
	)	GEN Docket No. 90-314
Amendment of the Commission's	)	ET Docket No. 92-100
Rules to Establish New Personal	)	
Communications Services	)	

REPLY COMMENTS OF SPECTRALINK CORPORATION

Thomas Ohlsson  
Product Manager  
SpectraLink Corporation  
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In the Matter of	)	
	)	GEN Docket No. 90-314
Amendment of the Commission's	)	ET Docket No. 92-100
Rules to Establish New Personal	)	
Communications Services	)	

### **EXECUTIVE SUMMARY**

SpectraLink believes that co-primary, shared-spectrum operation between unlicensed PCS systems and incumbent microwave users is not possible due to the inability of restricting the movement of an unlicensed PCS handset; therefore, the band should be cleared of existing microwave systems prior to the initial authorization of unlicensed PCS services.

SpectraLink believes that a minimum of 20 MHz should be allocated for voice-based services in order to ensure a degree of interference protection for users as competing, unlicensed PCS systems are deployed in relative proximity. Since it has been proposed that only 20 MHz be allocated for all unlicensed PCS services, including data services, additional spectrum should be immediately allocated to unlicensed PCS services.

SpectraLink believes that a "Listen Before Talk" protocol should not be required for isochronous (voice-based) services, as this adds potentially unacceptable delay and interruptions. The isochronous band should be channelized into 1.25 MHz segments. The

Commission should consider relaxing the frequency stability requirement to 50 ppm.

SpectraLink believes that the Commission should consider adopting the power density rule suggested by WINForum. SpectraLink is not in favor of requiring systems to use adaptive power control techniques as a method of reducing or minimizing adjacent system interference.

In the Matter of	)	
	)	GEN Docket No. 90-314
Amendment of the Commission's	)	ET Docket No. 92-100
Rules to Establish New Personal	)	
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**REPLY COMMENTS OF SPECTRALINK CORPORATION**

SpectraLink Corporation hereby submits its Reply Comments in response to the Commission's Notice of Proposed Rule Making and Tentative Decision, FCC GEN Docket No. 90-314 and FCC ET Docket No. 92-100, released August 14, 1992, relating to the amendment of the Commission's rules to establish new Personal Communications Services.

SpectraLink Corporation specializes in wireless business communications and has developed and is currently distributing a wireless PBX/Centrex adjunct product which augments an organization's existing phone system with wireless phone extensions. The SpectraLink product uses microcell technology and spread spectrum radio transmission in the 902 to 928 MHz bandwidth and operates under Section 15.247 of the Commission's Rules.

SpectraLink has demonstrated that it is possible to develop, within the confines of existing available spectrum, a microcellular system which provides the capacity and coverage necessary to meet the needs of large businesses. In order to do this, SpectraLink has

engineered a system which is spectrally efficient, with microcells and handsets that operate at power levels far below the one watt maximum mandated by Section 15.247 of the Commission's rules. Because SpectraLink has already overcome many of the obstacles associated with in-building wireless technology, it can provide useful comments on the Commission's Notice of Proposed Rulemaking and Tentative Decision in GEN Docket No. 90-314 and in ET Docket No. 92-100.

SpectraLink has had opportunity to review several Comments filed to the Commission pertaining to the Notice of Proposed Rulemaking and Tentative Decision in GEN Docket No. 90-314 and in ET Docket No. 92-100. SpectraLink will be making reply comments to those comments which pertain specifically to unlicensed PCS operation. As a member of the WINForum Technical Committee, SpectraLink has participated in the development of a technical etiquette proposal with other member companies. SpectraLink strongly believes that several important issues must be fully addressed in order to ensure the ultimate success of unlicensed PCS services.

### **Sharing the Band with Incumbent Microwave Operators**

SpectraLink agrees with the majority of companies that have filed comments that co-primary operation with incumbent microwave users is not possible due to the nature of the proposed unlicensed operations<sup>1</sup>. Therefore, the 1910-1930 MHz band should not be made available to unlicensed systems until all microwave users are relocated. A cleared band is essential for effective operation of the unlicensed services contemplated in this proceeding.

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1. See, for example, Comments of Northern Telecom in ET Docket No. 92-100 filed November 9, 1992 at page 16, Apple Computer Comments at page 4.

## **Spectrum Allocation**

SpectraLink recommends that a minimum of 20 MHz of spectrum be dedicated to unlicensed voice services, with additional spectrum held in reserve for future allocation to voice services. SpectraLink, as well as other manufacturers, has determined that a minimum of 10 MHz is required for the implementation of a primary service wireless PBX system<sup>2</sup>. The term "primary service" refers to a situation whereby all PBX users rely on a wireless handset as the primary telephone instrument.

In SpectraLink's opinion, in the absence of interference from competing systems or services, between 10 MHz to 15 MHz should accommodate an unlicensed wireless PBX system. However, upon activation of a second system operating in the immediate vicinity, such as in a high-rise office building, a contention factor of  $N \times 10$  MHz must be considered to prevent interference between two or more systems. SpectraLink suggests that this contention factor be on the order of 2 to 3, such that the minimum required spectrum allocation for unlicensed voice services is between 20 MHz ( $2 \times 10$  MHz) and 30 MHz ( $3 \times 10$  MHz).

## **Etiquette**

SpectraLink urges that an etiquette other than a "Listen Before Talk" protocol be established as the fundamental means of selecting a free channel in the isochronous (voice) portion of the unlicensed PCS spectrum. An etiquette such as "Listen Before Talk" imposes restrictions on the design of voice-based equipment that can result in interruptions and unacceptable delays. Indoor radio propagation

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2. In this connection, see Motorola Comments, at page 14.

is characterized by substantial multi-path interference and fading. For example, a faded condition may give false indication that a radio channel has been relinquished by a voice-based system. Another system, relying solely on a Listen Before Talk mechanism, may seize this channel after the requisite waiting period, but prior to the original system's radio link restoration. This results in the disruption and termination of an active telephone call for a voice-based system.

Listen Before Talk does not accommodate different bandwidth systems operating in the same spectrum. A narrowband system may not "hear" a medium bandwidth system that is experiencing a dispersive fade, and subsequently seize a radio channel which will result in interference to the original system.

In a cellular-based system, beacon channels are a reliable means of locating handheld phones to enable call processing. A system forced to comply with a Listen Before Talk requirement may have the beacon channel pre-empted by a user from another system, resulting in increased delays in alerting the wireless user of an incoming call. These delays, if great enough, can prevent an incoming call from reaching the intended recipient, rendering the system unacceptable.

Other means, such as "Least Interfered Channel", are more effective at selecting channel assignments for voice-based services. SpectraLink recommends that the basic etiquette requirements for the isochronous portion of the unlicensed PCS spectrum be limited to peak power output, power density, and bandwidth occupancy.



## **Channelization**

Voice and data services can be referred to as "isochronous" and "asynchronous" services, respectively, and should be kept to different portions of the unlicensed PCS spectrum<sup>3</sup>. This is because the requirements of voice-based systems are fundamentally different than for data-based systems, in terms of their frequency of access and the hold times required. Voice users cannot tolerate delays in the assignment of a channel, and cannot tolerate interruptions. A user would reject any wireless PBX that was subject to (dial tone) delays or periodic interruptions during conversations.

Furthermore, the voice segment of the unlicensed spectrum should be channelized in a manner that suits multiple technologies. This will serve to shorten the time-to-market of products. SpectraLink recommends that the isochronous portion of the unlicensed PCS spectrum be divided into 1.25 MHz segments. This will best serve the various technologies suitable for voice-based services.

A 1.25 MHz channelization scheme will adequately support a TDMA system offering 9-12 timeslots per radio channel, whereas lesser bandwidth systems (100-300 kHz) can be underlaid within a single larger channel. Interference between co-located systems can be minimized with a simple "clumping" procedure, whereby 1.25 MHz bandwidth systems start looking for clear spectrum from one end of the band, and lesser bandwidth systems start looking for spectrum from the other end. This will keep dissimilar systems apart from one another and helps interference avoidance.

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3. See Rose Communications Comments at page 9.

## **Spectral Efficiency and Power Density**

SpectraLink supports WINForum's proposed power density rule ( $p=1E-4 \cdot SQR[Hz]$ ) in lieu of the Commission's spectral efficiency relationship. The WINForum proposal is equitable to all technologies, and does not favor one technology (such as FDMA) over another technology (such as TDMA). It limits a 10 MHz wide-bandwidth system to 316 mW maximum vs. the Commission's proposed 1 watt maximum, and allows a 1.25 MHz medium-bandwidth system to achieve 111 mW maximum vs. the FCC's proposed 100 mW maximum. This proposal has gained wide acceptance within WINForum as a suitable means of equating power output to the actual bandwidth used.

## **Frequency Stability**

SpectraLink believes that the 1 ppm frequency stability requirement over a wide temperature range as proposed by the Commission is unnecessary and unwarranted. It is likely that the cost to design and implement a 1 ppm reference oscillator that will stay accurate over a range of temperature, shock and time is not feasible for a Part 15-type device.

The objective of the 1 ppm requirement is to keep all transmission within the passband of the unlicensed spectrum. This can be accomplished by specifying an out-of-band emissions criterion which will effectively obtain 1 ppm through filtering<sup>4</sup>. This allows a more practical reference oscillator with a frequency stability of +/- 50 ppm to be used.

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4. See Motorola Comments at pages 27-28.

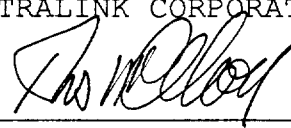
## **Adaptive Power Control**

SpectraLink would oppose an adaptive power control requirement for Part 15 equipment operating in the isochronous (voice) portion of the unlicensed PCS band.

Adaptive power control does not appreciably reduce inter-system interference, when taking into account that adaptive power control will normally attempt to compensate for indoor multipath interference and dispersive fading. Furthermore, it is likely that the random distribution of wireless handsets within a base station's range will virtually ensure that the base station is at or near full power a majority of the time. The strategic location of base stations, however, renders adaptive power control unnecessary, as handoff can provide effective frequency reuse and limit total radiated power levels. Adaptive power control adds unnecessary cost and complexity to the design of equipment and to the handoff algorithm.

Respectfully submitted,  
SPECTRALINK CORPORATION

By: \_\_\_\_\_

  
Thomas Ohlsson

Product Manger

January 8, 1993